THREE-PHASE STANDARD METER CIRWATT 400 B

USER MANUAL

(M98230701-03-13A)

E ADVERTENCIAS / SÍMBOLOS

PELIGRO	Una conexión incorrecta del equipo puede producir la muerte, lesiones graves y riesgo de incendio. Lea y entienda el manual antes de conectar el equipo. Observe todas las instrucciones de instalación y operación durante el uso de este instrumento. La instalación, operación y mantenimiento de este instrumento debe ser efectuado por personal cualificado solamente. El Código Eléctrico Nacional define a una persona cualificada como "una que esté familiarizada con la construcción y operación del equipo y con los riesgos involucrados".

ATENCIÓN	**Consultar el manual de instrucciones antes de utilizar el equipo** En el presente manual, si las instrucciones precedidas por este símbolo no se respetan o realizan correctamente, pueden ocasionar daños personales o dañar el equipo y /o las instalaciones.

GB WARNINGS / SYMBOLS

DANGER	Death, serious injury, or fire hazard could result from improper connection of this instrument. Read and understand this manual before connecting this instrument. Follow all installation and operating instructions while using this instrument. Installation, operation, and maintenance of this instrument must be performed by qualified personnel only. The National Electrical Code defines a qualified person as “one who has the skills and knowledge related to the construction and operation of the electrical equipment and installations, and who has received safety training on the hazards involved.”

WARNING	**Consult the instruction manual before using the equipment.** In this manual, if the instructions preceded by this symbol are not met or done correctly, can cause personal injury or equipment damage and / or facilities.

F WARNHINWEISE / SYMBOLE

DANGER	Un branchement incorrect de l’appareil peut entraîner la mort ou des lésions graves et peut provoquer un incendie. Avant de brancher votre appareil, lisez attentivement le manuel et assurez-vous de bien avoir compris toutes les explications données. Respectez toutes les instructions concernant le mode d’installation de l’appareil et son fonctionnement. L’installation, le fonctionnement et la maintenance de cet appareil doivent être réalisés uniquement par du personnel qualifié. Le code électrique national définit en tant que personne qualifiée toute personne connaissant le montage et le fonctionnement de l’appareil ainsi que les risques que ceux-ci comportent »

ATTENTION	**Consulter le manuel d’instructions avant d’utiliser l’appareil** Si les instructions suivantes, précédées dans le manuel d’un symbole, ne sont pas respectées ou sont réalisées incorrectement, elles pourront provoquer des dommages personnels ou abîmer l’appareil et/ou les installations.

D WARNHINWEISE / SYMBOLE

GEFAHR	Durch einen nicht sachgemäßen Anschluss der Anlage können Tod, schwere Verletzungen und Brandrisiko hervorgerufen werden. Bevor Sie die Anlage anschließen, lesen Sie bitte das Handbuch durch und machen Sie sich dessen Inhalt klar. Beachten Sie bei Einsatz dieses Instrumentes sämtliche Installations- und Betriebshinweise. Installation, Betrieb und Wartung dieses Instrumentes müssen ausschließlich von entsprechend qualifiziertem Personal vorgenommen werden. Von dem nationalen Elektrocode wird eine qualifizierte Person als jemand definiert, “der mit der Konstruktion und dem Betrieb einer Anlage und der damit verbundenen Risiken vertraut ist“.
ACHTUNG	**Vor Inbetriebnahme der Anlage ist das Handbuch zu lesen.** Werden die in dem vorliegenden Handbuch mit diesem Symbol versehenen Hinweise nicht beachtet oder falsch verstanden, können Personenschäden und Schäden an der Anlage und/oder den Installationen verursacht werden.

P ADVERTÊNCIAS / SÍMBOLOS

PERIGO	Uma ligação incorrecta do equipamento pode provocar a morte, lesões graves e risco de incêndio. Leia e compreenda o manual antes de ligar o equipamento. Observe todas as instruções de instalação e operação durante o uso deste aparelho. A instalação, operação e manutenção deste aparelho devem ser levadas a cabo exclusivamente por pessoal qualificado. O Código Eléctrico Nacional define uma pessoa qualificada como "uma pessoa que se encontre familiarizada com a construção e operação do equipamento assim como com os riscos inerentes”.
ATENÇÃO	**Consultar o manual de instruções antes de utilizar o equipamento** No presente manual, se as instruções que precedem este símbolo não forem respeitadas ou realizadas de forma correcta, podem ocorrer ferimentos pessoais ou danos no equipamento e/ou nas instalações.

I AVVERTENZE / SIMBOLI

PERICOLO	Un collegamento errato del dispositivo può provocare morte, lesioni gravi nonché rischio di incendio. Prima di collegare il dispositivo leggere attentamente il manuale. Osservare tutte le istruzioni relative all’installazione e all’operatività durante l’uso di questo strumento. L’installazione, operatività e manutenzione di questo strumento devono essere realizzate solamente da personale qualificato. Il Codice Elettrico Nazionale definisce una persona qualificata come “colui che ha familiarità con la costruzione e operatività del dispositivo e con i rischi che ne possano derivare”.
ATTENZIONE	**Consultare il manuale di istruzioni prima di utilizzare il dispositivo** Qualora le istruzioni riportate nel presente manuale precedute da questo simbolo non vengano osservate o realizzate correttamente, possono provocare danni personali o danneggiare il dispositivo e/o gli impianti.

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1.- GENERAL DESCRIPTION OF THE METER

1.1.- Introduction

Cirwatt B is a three-phase static meter for metering purposes. Class B for active energy (Class 1 as IEC 62052-11 and IEC 62053-21) and Class 2 for reactive energy (IEC 62053-23) in compliance with MID directive (EN 50470) with optional PLC, GSM/GPRS, Ethernet, RS232 and RS485 communications.

1.2.- Meter versions

The following table shows all of the possible options available for the Cirwatt Type B meter. This table is generic, and as such not all of the versions listed in it may currently be available.

METER TYPE	TBT STD semi-indirect	TBT STD Direct		
4 wire	•	•	4	*Connection mode*
Class B Active (Class 1) / Class 2.0 Reactive	•	•	10	*Accuracy*
3x63,5/110V	•		M	*Measurement voltage*
3x127/220V	•	•	N	
3x230/400V	•	• (1)	Q	
3x127/220V… 3x230/400V		•	U	
3x57/100V… 3x230/400V	•		V	
Transformer 1(2) A	•		T1	*Measurement current*
Transformer 2,5(10) A	•		T2	
Transformer 5(10) A	•		T5	
Transformer 1(6) A	•		T7	
Transformer 1(10) A	•		T8	
Direct 10(100) A		•	D1	
Direct 5(60) A		•	D2	
Direct 10(120) A		•	D3	
Direct 15(120) A		•	D5	
Direct 5(100) A		•	D6	
50Hz			A	*Frequency*
60Hz			B	
Without communications			0	*Communications*
R1 / R2 (PLC)	RS485 / (PLC A)	RS485 / (PLC A)	2	
R1 / R2 (PLC)	RS232 / - (PLC A)	RS232 / - (PLC A)	4	
R1 / R2 (PLC)	RS232 / - (PLC B)	RS232 / - (PLC B)	5	
R1 / R2	RS232 / RS232	RS232 / RS232	7	
R1 / R2	RS485 / RS485	RS485 / RS485	8	
R1 / R2	RS232 / RS485	RS232 / RS485	9	
R1 / R2	RS232 / Ethernet	RS232 / Ethernet	A	
R1 / R2	RS485/ Ethernet	RS485/ Ethernet	C	
Without inputs/outputs	•	•	0	*Expansion modules*
4 relay outputs (tariff indicator)	•	•	3	
2 relay outputs / 4 pulse inputs	•	•	5	
Auxiliary power supply (24-48Vd.c.)	•	•	6	
4 pulse inputs	•	•	A	
Earth leakage measurement	•	•	B	
2 relay outputs/ 2 pulse outputs/ 2 pulse inputs	•	•	D	
Model	•	•	B	*Model*
2 Quadrants	•	•	0	*Quadrants*
4 Quadrants	•	•	1	
Unidirectional	•	•	2	
No additional features	•	•	0	*Extra features*
With three phase internal breaker		• (1)	2	

(1) Option only available for direct meters with three phase internal relay.

Example: The code ***410UD1A90B10*** represents a *Type B Standard meter, Class B for active energy (Class 1) and Class 2 for reactive energy, with asymmetric connection, 50Hz, 4 quadrants; with supply/ voltage between 3 x 127(230)V and 3 x 230(400)V and 10(100) A , with RS232 and RS485 communications; without expansion module or extra features.*

1.3.- Metrology

The metrological characteristics for the Cirwatt Three-Phase Type B (TBT) are:

- The current sensor is of the current transformer type.
- Current ranges:

		Active Class B (1)
Indirect / semi-indirect connection version		
	I_{tr}	0,250
	I_{st}	0,010
	I_{min}	0,050
	I_n / I_{ref}	5,000
	I_{max}	10,000
Direct connection version		
	I_{tr}	1,000
	I_{st}	0,040
	I_{min}	0,500
	I_n / I_{ref}	10,000
	I_{max}	100,000

1.4.- Measured magnitudes

The meter is able to measure the following variables:

- Imported and exported active and reactive energy in the four quadrants.
- Active and Reactive Power.
- Instantaneous current and voltage.
- Cos φ.

1.5.- Nominal, maximum and minimum operating conditions

1.5.1.- Electrical parameters

- Reference voltage (U_{ref}): 3x57/100V to 3x230/400V (depending on version)
- Operating voltages
  - minimum: 80% U_{ref}
  - maximum: 120% U_{ref}

- Reference frequency: 50-60 Hz
- Absorbed power per phase: <2W; <10VA for Ib, U_{ref} (without expansion modules)

1.5.2.- Environmental parameters

- Minimum temperature: -40 ºC
- Maximum temperature: +70 ºC; 95% relative humidity.

1.6.- Built features

1.6.1.- General information

The meter has an insulating enclosure with class II protection and double insulation.

As specified in the directives 2002/96/CE and 2002/95/CE, none of the materials or substances listed in them are used. The materials used are fire retardant, halogen free and with low emissions of opaque, toxic or corrosive fumes. The running of the equipment is not affected by the presence of external magnetic fields.

The meter manufacturer certifies that, at a temperature of 35ºC, the device will have a minimum service life of 20 years.

1.6.2.- Environmental characteristics

The meter provides:

- Protection levels provided by the enclosures, Code IP51, CEI 60529:2001 standard.
- Protection against salt mist, standard UNE-EN 60068-2-11:2000.
- Resistance against ultraviolet rays, standard UNE-EN 60068-2-5:2000.

1.6.3.- Voltage connection

The jumper internally separates the voltage and current circuits, making it impossible to manipulate them externally.

In the indirect and semi-indirect connection models, the voltage and current circuits are separated galvanically.

1.6.4.- Seals

The cover and the lower slot of the meter are closed, it being impossible to open or insert foreign objects without breaking the enclosure. In addition, the device is equipped with all the regulation seals: on the meter cover, the sealable button and the wire cover.

1.6.5.- Wire cover (depending on version)

The meters feature an opaque cover over the upper part of the terminal box, the fixing screws and the connection conductors.

The bottom part of the cover is designed in such a way that it can be easily broken to allow the wires to be partially exposed whilst protecting access to the terminals.

The meter is fitted with a sensor that can detect the opening and closing of the wire cover. This detection always takes place, even if the meter is not connected to the electrical supply.

On the wire cover, the meter is fitted with a DB9 connector for a local connection using an electrical serial port.

1.6.6.- Terminal cover (depending on version)

The meters feature an opaque cover over the upper part of the terminal box and the fixing screws. The meter is fitted with a sensor that can detect the opening and closing of the terminal cover. This detection always takes place, even if the meter is not connected to the electrical supply.

1.6.7.- Terminal box

Screws

The screws are of mixed type, allowing the use of both Phillips and flat screwdrivers. A double screw fixing is used, with the screws being designed to reduce the stripping caused by the numerous operations of tightening and loosening that can take place over the course of the lifetime of the meter

Terminals

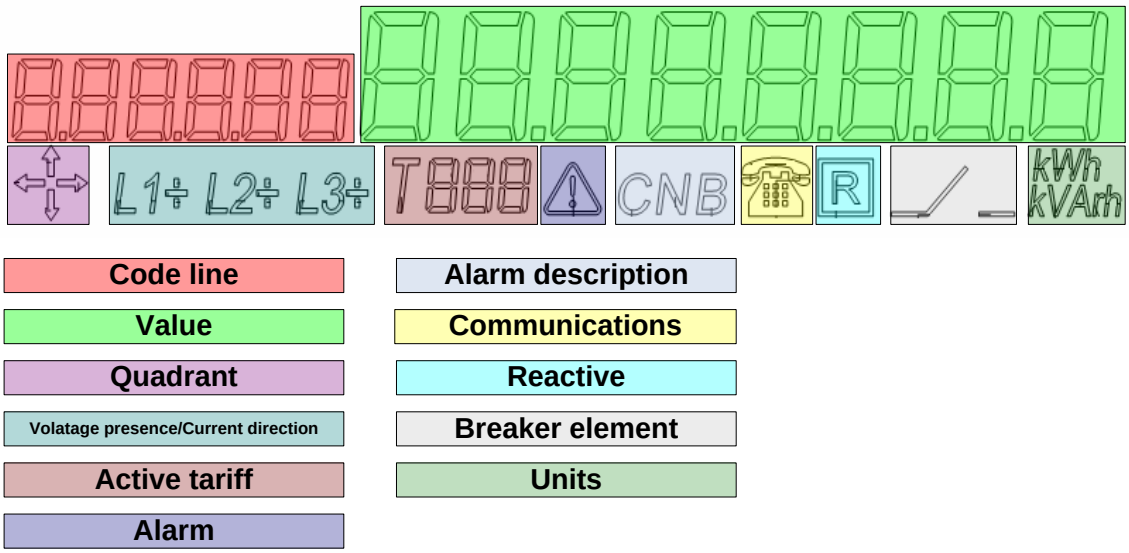
All the terminals are indelibly numbered on the front, from left to right, with the function of the meter being indicated on the characteristics label situated on the meter's casing.

Auxiliary terminals

These are situated a level above the main terminals, and they are numbered from left to right, starting at 21.

1.7.- Data presentation

Data is presented using an LCD screen specially designed for this application, where all information can be viewed, such as: energy measurements, electrical parameters, status indicators, etc.



- *Code line*. Shows the code for the variable being displayed on the data line.
- *Data line*. Area where information about the electrical parameters, the meter, etc. is displayed.
- *Units*. Unit of the value that is being displayed.
- *Indicators.* The meter uses the second line of each screen's display to show the indicators. The display format is presented as follows:
  - , the active quadrant (Q1,Q2,Q3,Q4)
  - **L1+L2+L3+**, indicates the presence of electrical current in each phase, along with the corresponding flow direction:
    - "+", is used to show the power absorbed from the network.
    - "–", is used to show the power yielded to the network.
    - " ", the absence of any symbol is used to indicate that there is no load.
  - **PX** , indicates the active period at any given moment.

- ⚠ , indicates an alarm state. The type of alarm can be consulted on the L40 screen.
- When a critical alarm is triggered, the device will continuously display on the top line of the Stand-by Mode the message "ALARM". To access the different screens it will be necessary to use the read button. Depending on the alarm the following letters will appear on the display:

  C: Critical alarm due to internal or external incidents directly affecting measurement. This will be flashing.

  N: Non critical alarm not affecting measurement creating a meter malfunction. This will be flashing.

  B: Low battery alarm. This will be flashing.

- ☎ , has three possible states:
  - Off, when no communications are under way. This is the default state.
  - On continuously, once the meter has been associated with a concentrator.
  - Blinking, of which there are two possible variations:
    - Continual regular blinking, indicating that the meter's communications module is working correctly during the association process but that the meter has not yet been associated with the concentrator. The blinking lasts for 2 seconds: off for 1 second and on for 1 second.
    - Short double blinking, indicating that the meter has a connection and has been associated. The symbol is off for 0.3 seconds between blinks.
- R, indicates that the LED verifies the reactive energy measurement. Not available on three-phase meters.
- —/— , indicates that the Circuit Breaker is open because the Power Control (PC) feature has been activated. Not available on three-phase meters.

1.8.- Verification impulses

The device features two verification LEDs: one for verifying the active energy, and another for the reactive energy.

The weight of the LEDs depends on the version of the meter, being 20,000 imp/kWh (kVArh) for the indirect and semi-indirect meter, and 4,000 imp/kWh (kVArh) for the direct connection meter.
The LEDs remain lit when the current is below the meter's start-up current. Once the start-up current has been passed (because of the existence of either active or reactive power consumption), the LEDs turn off and emit pulses in proportion to the energy being measured, in accordance with the cadence indicated on the characteristics label.

Both LEDs have metal loops and a profile which allows them to be attached and to help position the verification port.

1.9.- Button

The device uses two buttons, employing a system of either short or long button presses. A short press is understood to be one that lasts less than 2 seconds, and a long press one that lasts more than 2 seconds. The effect of pressing each button depends on the version of the meter. One of the buttons is sealed in order to prevent the meter being tampered with by unauthorised personnel.

1.10.- Nameplate

The characteristics plate is situated on the front part of the meter, and includes all the information established in IEC 62052-11:

- Manufacturer name and place of manufacture.
- Designation of the type and indications relating to its approval.
- The number of phases and the number of conductors in the circuit to which it can be connected (e.g. three-phase 4 wire).
- Serial number of the meter (9 numerical characters); this is a number which uniquely identifies each meter.
- Year of manufacture; the year in which the meter was built.
- Reference voltage, according to the assigned network voltage or the secondary voltage of the measuring transformer to which the meter is to be connected.
- Reference current and maximum current; for example, 10 (100) A would indicate a meter with a base current of 10 A and a maximum current of 100 A.
- Reference frequency, in Hz.

- The meter constant; the ratio of active/reactive energy pulses, which defines the frequency of the blinking of the LED.
- The class index of the meter.
- The double square symbol , showing that it is a meter with a protection class II isolating enclosure.
- The number and the arrangement of the metering elements.
- Barcode, in accordance with EN 207010, identifying the meter.
- Model ID. Manufacturer's code used to identify the meter model. With this code, the meter's configuration is known: power, current measurement, measuring system, etc.
- Temperature range -40ºC…+70ºC.
- Minimum current.
- Additional metrology mark.
- CE mark.

1.11.- Enclosure

The dimensions of the CIRWATT enclosure, as well as its fixing points, are in accordance with the DIN 43859 and DIN 43857 standards.

1.12.- Connection

A figure showing the electrical connection is etched by laser onto the meter casing. In the event that it may be required, a brief installation manual is also included, to facilitate the initial start-up tasks.

1.13.- Auxiliary contacts (depending on version)

The meter may feature a series of auxiliary contacts with various different functions, depending on the version.

1.13.1.- Version with tariff indicator output

The meter will feature a relay-type output (250 V and 5 A AC) which indicates the activation of the programmed tariff.

1.13.2.- Version with impulse input

The meter could have up tp 4 inputs for metering impulses from other devices, such as water and gas meters, for example. The minimum impulse width time detected by the meter is 30 sec. and the maximum cadence to read is 8 impulses per second.

The inputs are self-powered at +5V, with a maximum current of 8mA per input.

1.13.3.- Version with leakage current measurement

The meter will feature an input for connecting an external transformer from Circutor's WN series, which will allow for the reading of the differential (leakage) current existing in the installation.

1.13.4.- Version with Optocoupler output

The meter could have a optocoupler output card to send pulses related with the energy read by the meter. The maximum voltage is to apply is 24 V d.c.

1.14.- Real-time clock

The meter features a real-time clock able to maintain the date and time with a loss of accuracy of less than 0.5 seconds/day, as specified by the UNE EN 61038 standard.

The clock maintains this precision both when powered using the electricity network and when using its own battery.

1.15.- Reserve power

The meter is equipped with a battery that allows the real-time clock to continue running. This battery is non-removable and is designed to provide energy for a period of 5 years whilst the meter is otherwise without power. When the meter is powered as normal, the battery consumption is practically zero. The use of laser-sealed batteries ensures minimum auto-discharge, making it possible to guarantee the battery for the 20 years of service life of the meter.

1.16.- Optical communication port

The equipment, in all the different versions, features an optical serial communications port, in accordance with the UNE IEC 62056-21:2003 standard. The communications port is fully compatible with the optical ports approved by the major electricity companies.

The surface of the cover includes a profile for the correct fastening and placement of the optical ports.

1.17.- PLC communication port (depending on model)

The Cirwatt Type B meter can be fitted with an advanced communications system for communicating over the electrical distribution network (PLC). This system allows meters to be networked without the need for extra wiring, with the subsequent cost savings in the reading processes and the ability to carry out remote management. It is based on DCSK modulation and a series of repeaters.

1.18.- RS232-RS485 Communication ports

The meter can be fitted with RS232 or RS485 serial communications. Up to two totally independent channels, with speeds from 9600 up to 38400 baud, can be made available.

1.19.- Ethernet communication port (depending on model)

The Cirwatt Type B meter can be connected to an Ethernet network, allowing the meter to be accessed directly over IP.

1.20.- Reset

The device can be reset to the initial factory settings using this local function.

1.21.- Contracts

In addition to the basic measurements, it is also necessary for the device to carry out a series of calculations that will allow for adequate billing, which leads us to the concept of contracts.

A contract is understood to be the set of parameters that structures the handling of the measurements, to be carried out by the analyser, in order to reflect the contracted billing agreements.

1.21.1.- Number and contracts assignment

The meter has three defined contracts.

1.21.2.- Contract parameters

A parameter is considered to be defined if it has a value assigned to it. It is considered undefined if it is blank.

A parameter that is not used will not be able to have any value assigned from previous parameterizations and, as such, will be left undefined.

Activation date

This is the date from which the meter must use the contract parameters to calculate the data necessary for billing.

Season

A season is defined as a period of time into which a calendar year can be divided and during which time the billing conditions associated with it do not vary. The maximum number of seasons is 4.

Two types of season are considered:

- Winter / Summer seasons. These split the year into two unique seasons and are delimited by the dates of the official daylight saving clock changes, without the need for any parameterization. It adjusts the data automatically every year.

- Defined seasons. Each season begins on a determined date, with its end being marked by the start date of the next chronological season, regardless of the year. Each one is

identified by a number, starting at 1 and incrementing by one unit up to the maximum of 4.

Type of days

The days of the year are classified as either:

- Working.
- Holiday.

Working days are considered to be Monday, Tuesday, Wednesday, Thursday and Friday. They all receive the same tariff treatment throughout an entire season.

Holidays are considered to be Saturday, Sunday and all other days considered as non-working. They all receive the same tariff treatment throughout an entire season.
Holidays other than Saturdays and Sundays will be identified by their dates, the format of which can contain wildcards.

Tariff periods. Type of day

A tariff period is each hourly block in which a determined tariff is applied. For the regulated market and ATR, the Public Administration defines them each year. In addition to these ones, there may exist other different periods agreed upon in contracts between the Client and the Supplier. There will exist a minimum of one hourly block and a maximum of six. Each period is identified using an incrementing number, starting at 1.

Type of day

The type of day is the total set of tariff period assignments made to each of the 24 hours in a day.Each type of day is identified by number, starting at 1 and incrementing by one unit for successive types.

Working days and holidays have an associated type of day for each season. Each special day also has an associated type of day.

Power ratings

Each tariff period has an associated power rating, which corresponds to the value of the power contracted in each period. This is the base of the calculations for the billing of the excess power demanded from the network.

In the event that this parameter is not defined in any tariff period, it will be understood that there is no power contracted by period, for which reason the excesses are not calculated. If the power rating is defined in one or more tariff periods, the rest of the periods in which it is not defined will be considered to have a defined power rating of zero and the excesses will be calculated for all the periods.

1.22.- Billing closures

A billing closure is considered to mean the storage, in a memory register and at a determined moment, of the following values:

- Values indicated by the energy totalizers at a given moment (absolute reading).
- Values of the energy measurements since the previous closure or since the start-up of the meter, in this closure is the first (incremental reading).

The measurements and calculations that must be stored are:

- Active energy, as both absolute and incremental values.
- Inductive and capacitive reactive energy, as both absolute and incremental values.
- Calculated average maximum active power in a quarter of an hour.
- Calculated power excesses.

The billing closures are over the total measurements and all the tariff periods of the active contracts.

Each closure includes the associated date and time when it took place. A minimum, configuration, time must elapse between two consecutive closures, expressed in minutes. By default, this time is 10 minutes.

The meter keeps a historic register of the 12 most recent closures for each of the contracts that it holds, arranged chronologically from the most recent to the oldest.

The types of closure are:

- This closure can be made at any time by means of a manual order, by pressing a button or sending a communications message. The power values are considered up until the end of the quarter-of-an-hour integration period immediately prior to the moment in which the order is given. The energy values will be those indicated by the totalizers in the moment the order is received. Ordering a closure manually using the button affects all of the active contracts. A closure via a communications message may affect one or more of the active contracts.

- Automatic closure. Programmable parameters indicate the date on which each contract is to be closed automatically. The date can contain wildcards in the month and year. This type of closure can affect one or more of the active contracts

An extraordinary immediate closure is automatically carried out in the following cases:

- Change of transformer ratio. This affects all contracts.
- Change of contracted power per period. This affects the modified contract.
- Change of season or type of day. This affects the modified contract.

1.23.- Maximeter

The maximum is the highest active power value demanded within a period of 15 minutes, in the time between two consecutive billing closures.

The 15-minute periods will coincide with the quarter-of-an-hour integration period of the load curve. As such, for each hour they will begin on the minutes 0, 15, 30 and 45, ending with the start of the following period.

The maximums are associated with each of the defined tariff periods and to the entire set. Each one of these values is associated with the date, hour and minute in which it was produced.
Those 15-minute periods in which a synchronism action, a power supply cut-off or reconnection, or a parameter change or intrusion occurred, or those which have an invalid bit, will not be taken into account when the maximum is calculated.

1.24.- Defined, active and latent contracts

A contract is considered to be defined when at least the seasons and types of day are defined. A defined contract is active when it is being used to do the calculations necessary for billing.

The TB three-phase meter also features latent contracts. The latent contracts function allows for the parameters of the active contract to be modified prior to the date on which it comes into effect. A contract changes from latent to active in the moment in which the activation date is reached, even if the device is without power or is starting up when power is recovered.

When the activation date of a latent contract is reached, the meter automatically carries out an extraordinary immediate billing closure of the affected contract. The parameters that the latent contract has defined are included in the active contract; the parameters of the latent contract become undefined, with the latent contract thereby being deleted at this point.

In the event that there exists an active contract and other, different ones are defined and activated, the registered information will not be altered in the moment of activation and all the data of all of the active contracts will be stored and will be available for viewing.

1.25.- Modifying contracts

Modifying a contract is understood to mean defining, changing or deleting any parameter of a previously defined contract.

Modification can affect an active or a latent contract (if there are any).

Even though the parameters of a contract form a single set, modifications can be made partially and independently by parameter group. These groups are determined by the coherence that exists between the parameters found in each of them.

In the event that a group of power ratings is modified, it may be necessary to previously modify the group of seasons and types of day in order to maintain coherence.

The groups are:

- Holidays (up to 15).
- Power ratings.
- Date of automatic billing closure.
- Seasons (4) and types of day (6).

Modification is done by complete groups, deleting the existing parameters and replacing them with those defined in the modification.

The modification of the Powers (power ratings) and Seasons/Types of Day groups triggers an automatic billing closure, which will take place prior to the implementation of the modification. In the event that the two groups are modified in a single operation, only one billing closure will take place. The rest of the groups are modified immediately, without triggering any closure.

If the modification supposed a reduction in the number of billing periods, the meter/analyser - at the moment in which the modification is made and a billing closure takes place - will do the following:

- Store in memory and make available for viewing the registers of the closures made up to that point.
- Keep the values of the global totalizer and of those whose period number remains. From this moment on, the global totalizer and the totalizers of the periods that have kept their number with the new definition will be viewable and will continue to increment, with those that have been deleted no longer being viewable or registered.

In the case of modifications to contracts that suppose extensions to billing periods, a billing closure will be carried out when they are activated, with the information registered up to that point and the values of all of the totalizers being maintained. The totalizers of the new periods start with the initial value of zero, and the existing ones increment from the value they held previously.

1.25.1.- Modifying an active contract

The modification of an active contract can effect one or more groups of parameters, and their activation will be immediate. Depending on the parameters, and before they are changed, an automatic billing closure for the affected contract will be carried out.

1.25.2.- Modifying a latent contract

The modification of a latent contract can effect one or more groups of parameters, but does not trigger any automatic closure.

If the activation date is prior to the current date, the effect will be the same as with a modification of an active contract, and said activation date will be ignored.

If a modification takes place with an activation date which is different to the existing date and which is after the current one, the date from the latest modification is taken as the new activation date.

1.25.3.- Deleting contracts

Deleting a contract leaves all previously defined parameters undefined, and removes all data referring to it from the screen.

If more than one contract has been defined and is active and one of those belonging to the set is deleted, a billing close for the contract to be deleted is carried out in that moment and from then on the information referring to the deleted contract is removed, with no information about it being displayed other than that relating to any existing billing closures. The rest of the contracts and the corresponding totalizers are not modified.

1.26.- Load curve

The meter features two load curves, in accordance with the specifications included in Royal Decree 2018/1997 and its Complementary Technical Instructions. Both load curves store registers with the number of fields demanded by this standard. The depth of the register is in both cases 4,000, and the integration period is completely user-configurable. With a period recorder of 1 hour, the meter can save more than 5 months of load profile.

In the event of voltage drops or clock changes, any gaps produced in the load curve are filled in with zeros.

An incremental load curve value that does not correspond exactly to the time at which it is included is marked as invalid. For example, this would be the case for a value that corresponds to the consumption of several time different times.

If in the request for a load curve quantities that are not registered on the device are requested, those that are registered will be sent and zero and void will be sent for those that are not registered.

In both cases, the resolution is 6 digits for the energy values measured in kWh or kvarh (the same as that in the meter display).

The load profile is initialized if the period of register is modified.

1.27.- Power excesses

These are calculated according to the average power in the last quarter of an hour and the contracted power, in accordance with RD164/2001.

$$\sqrt{\sum_{j=1}^{j=n}(Pdj - Pci)^2}$$

Where:

Pdj = power demanded in each quarter of an hour of the period i in which
Pci has been exceeded.
Pci = power contracted in the period i in the period in question

1.28.- Events

All of the dates of setup modifications, battery changes, clock changes, billing closures, etc. are registered.

The device has a storage capacity of 200 registers. Data within the file is organized in a round-robin structure. This means that once the memory is full, the new data will be saved over the top of the oldest data. This system ensures that the meter always has up-to-date information, and that this corresponds to the latest obtained data.

1.29.- Daylight saving time

The meter will automatically make the changes necessary for daylight saving time. In the event that the device is without power at that moment, the change will be made when power is restored and the device starts up.

The parameters that define this change have two different formats: one of them is generic, allowing for automatic annual updates, and the other incorporates the parameters included in the specific message from the communications protocol. The formats are:

- Generic format, independent of year, with month, day, time, and pre-established move forwards or backwards, in accordance with current regulations (last Sunday in March, and last Sunday in October).
- Format specifying the year, with month, day, time, move forwards or backwards.

The daylight saving parameters, regardless of which format they are programmed in, are automatically updated at the beginning of the year, in accordance with the generic format. In the event that the message for the updating of daylight saving time is received within the communications protocol, the format will be modified according to what is established in last message.

1.30.- Features

Power supply	
Mode	Self-powered
Nominal voltage	3 x 57(100) to 3 x 230(400) V
Tolerance	± 20%
Consumption	< 2W 10VA
Frequency	50 or 60Hz
Operating temperature	-40 ºC … +70 ºC
Voltage measurement	
Connection	Asymmetrical
Reference voltages	3 x 57(100) to 3 x 230(400) V depending on version
Frequency	50 or 60Hz
Self-consumption of the voltage circuit	< 2W 10VA
Current measurement	
Currents (In)	5 A (semi-indirect version) 10 A (direct version)
Maximum current	10 A (semi-indirect version) 100 A (direct version)
Start-up current	< 10 mA
Self-consumption of the current circuit	0,3 VA to 10 A
Accuracy	
Active Energy	Class B (EN 50470)/ Class 1(IEC 62052-11, IEC 62053-21 and IEC 62053-22)
Reactive Energy	Class 2.0 (IEC 62053-23)
Calculation and processing	
Microprocessor	16-bit RISC
Converter	16-bit
Memory	
Data	RAM type, Lithium battery powered
Setup, events, load curve	Non-volatile FLASH-type memory
Battery:	
Type	Lithium
Lifetime	> 20 years
Reserve power whilst meter without power	> 5 years
Clock:	
Source	Self-compensated quartz crystal oscillator
Drift	< 0,5 seconds/day at 25 ºC

Tariff output (depending on version)	
Type	Relay
Operational	Selection of the activation rate
Electrical characteristics	Max. 250V AC 5A with connection to the neutral potential when activated

Impulse input (depending on version)	
Type	Insulated via optocoupler
Operational	Reading of impulses with width >30ms. Maximum of 8 impulses/sec.
Electrical characteristics	Self-powered at +5V. Maximum current: 8mA

Leakage current (depending on version)	
Type	Suitable for use with Circutor WN transformers
Operational	Measurement of leakage currents detected by the WN, with a cadence of 1 second
Electrical characteristics	Maximum current: 300mA + 20% overrange

Build features	
Enclosure	In compliance with DIN 43859
Dimensions	In compliance with DIN 43857
Degree of protection	IP 51

Optical port	
Hardware	EN 62056
Speed	9600
Protocol	REE Protocol, based on IEC-870-5-102

PLC (depending on version)	
Protocol	REE Protocol, based on IEC-870-5-102
Modulation system	DCSK with repeater system
Consumption	1.2W 12VA

Electric port (depending on version)	
Hardware	RS232 or RS485
Speed	From 9600 to 38400 baud
Protocol	REE Protocol, based on IEC-870-5-102

Ethernet (depending on version)	
Hardware	Ethernet
Speed	From 9600 to 38400 baud
Protocol	REE Protocol, based on IEC-870-5-102

Tampering detector	
Activation	Manipulation of the meter or connections
Delay	Activation is delayed by 72 hours to allow for installation
Insulation	
Alternating voltage	4 kV RMS 50 Hz for 1 minute
Over-impulse	
1.2/50 ms 0W source impedance	6 kV at 60 ºC and 240 ºC with positive and negative polarity
Tests/Standards:	
EN 50470-1 and EN 50470-3	Standards for static, active-energy meters for alternating current, Class B.
IEC 62052-11, IEC 62053-21	Standards for static, active-energy meters for alternating current, Class 1.
EN 55022	. Driven emissions: Class B Radiated emissions: Class B
EN 61000-4-11	Gaps or brief voltage interruptions
EN 61000-4-2	Electrostatic discharges
EN 61000-4-3	Radio-frequency electromagnetic fields
EN 61000-4-4	Electrical transient bursts
EN 61000-4-5	Shockwaves
EN 61000-4-6	Alterations driven and induced by radio-frequency fields
EN 61000-4-8	Magnetic fields in the grid frequency with an external origin

1.31.- Safety

1.31.1.- Tampering detector

The equipment will generate an event and activate the alarm whenever its cover is lifted. The alarm can only be deactivated using communications protocols. The minimum time between two tampering events is 60 seconds.

During the initial startup, the meter will wait 72 hours before generating the first tampering event in order to avoid its activation whilst the authorized installer is fitting the equipment.

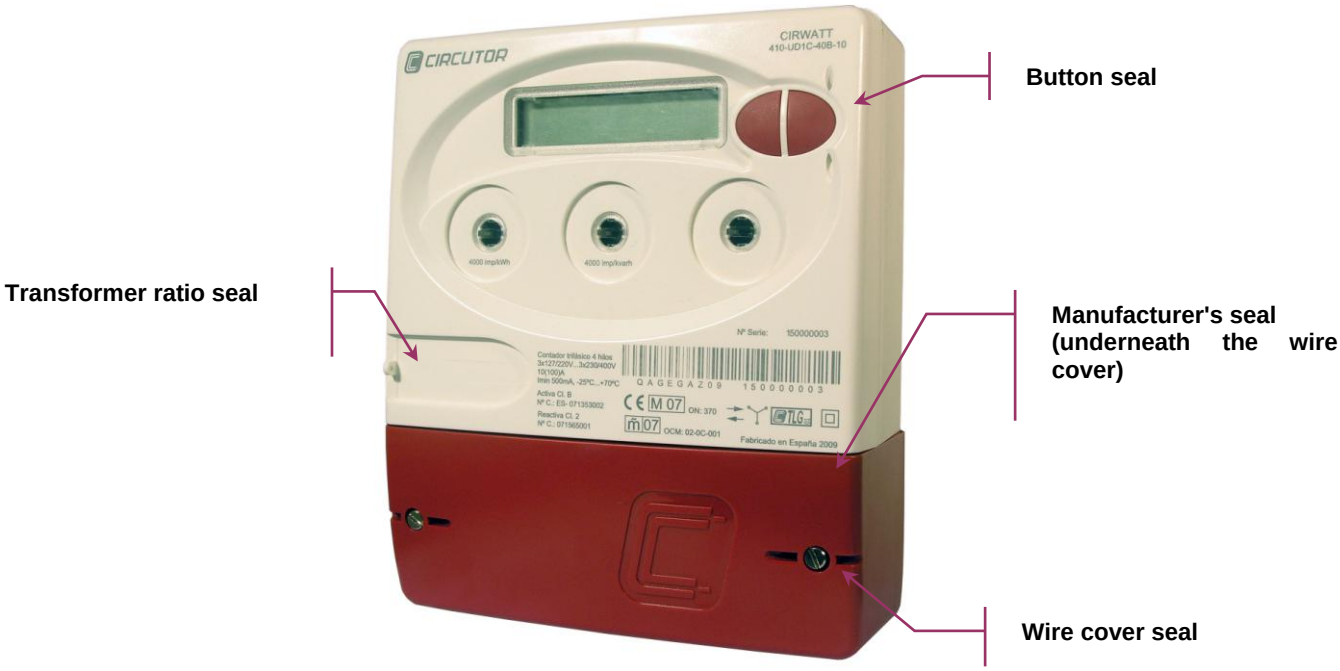
1.31.2.- Protection of the information stored in memory

All access to the meter memory via remote connections is protected by read and write keys.

These keys have more than 4 billion different combinations, granting the meter very strong protection against attempts to alter the registered information (energy curves, events, billing, setup).

1.31.3.- Seals

The CIRWATT Type B meter can be protected using the following seals:



1.32.- Measurement validation criteria

Energy, maximeter and excesses registers will be invalidated following the occurrence of a series of events that implies that their values are false. In the specific case of the load curve registers, there exists an invalid bit (IV) which indicates that that register is no longer valid. The events that lead to this invalidity of the measurements are described below.

1.32.1.- Time synchronization with drift > T1 = 30 seconds

The quarter-of-an-hour period in which the synchronization takes place will be ignored for the power calculation.

1.32.2.- Time synchronization with drift >10 minutes

The measurement is invalidated, i.e. flag IV = 1.

1.32.3.- Communication failure between meter and analyzer

If the communications failure coincides with the quarter-of-an-hour period change, and its duration is longer than 30 seconds, the affected periods will be ignored for the power calculation.

If the communications failure coincides with the quarter-of-an-hour period change, and its duration is longer than 10 minutes, the measurement of the affected periods will be invalidated, i.e. flag IV = 1.

1.32.4.- Power fail in one or more phases

The measurement for the period in which the failure has occurred is invalidated, IV = 1.

1.33.- Applicable standards

The Cirwatt Type B meter complies with the following standards:

- *IEC 62052-11:2004* - Electricity metering equipment (AC). General requirements, tests and test conditions. Part 11: Measuring equipment.
- *IEC 62053-21:2003* - Electricity metering equipment (AC). Particular requirements. Part 21: Static meters for active energy (classes 1 and 2).
- *IEC 62053-23:2003* - Electricity metering equipment (AC). Particular requirements. Part 23: Static meters for reactive energy (classes 2 and 3).
- *IEC 62056-21:2003* - Electricity metering equipment. Data exchange for meter reading, tariff and load control. Part 21: Direct local data exchange.
- *UNE 20324:1993* - Degrees of protection provided by enclosures (IP Code). (IEC 529:1989).
- *IEC 60068-2-11:2000* - Environmental testing. Part 2: Tests. Ka test: Salt mist. (IEC 60068-2-11 (1981-01)).
- *IEC 60068-2-5:2000* - Environmental testing. Part 2: Tests. Sa test: Simulated solar radiation at ground level.
- *UNE 207010:2003* - Bar code application for the coding of electrical energy meters.
- *IEC 62052-21 (2004-05)* - Electricity measuring equipment (AC). General requirements, tests and test conditions. Part 21: Tariff and load control equipment. (Replaces IEC 61038).
- *IEC 62054-21 (2004-05)* - Electricity metering (AC) - Tariff and load control - Part 21: Particular requirements for time switches. (Replaces IEC 61038).
- *DIN 43857 (1978-09)* - Watthour meters in moulded insulation case without instrument transformers, up to 60 A rated maximum current; principal dimensions for single-phase meters.

2.- METER CALCULATIONS

2.1.- Nominal Voltage

$$V_{RMS} = \sqrt{\frac{1}{64}\sum_{n=1}^{64} v_n^2}$$

2.2.- Nominal current

$$I_{RMS} = \frac{S}{V_{RMS}}$$

2.3.- Apparent power

$$S = \sqrt{P^2 + Q^2}$$

2.4.- Active power

$$P = \frac{1}{64}\sum_{n=1}^{64} v_n i_n$$

2.5.- Reactive power

$$Q = \frac{1}{64}\sum_{n=1}^{64} v_n i_{n90}$$

2.6.- Power factor

$$FP = \frac{P}{S}$$

2.7.- Maximum demand

The maximum demand is calculated from the instantaneous power of each second. This power is averaged over a period of integration (15 minutes), obtaining MD_{15}.

$$MD_{15} = \frac{1}{900}\sum_{n=1}^{n=900} P_n$$

The maximum demand between two bill closures corresponds to maximum value of each of these values averaged every 15 minutes (MD_{15}).

$$MAXDEM = Max(MD_{15})$$

2.8.- Energy

$$EnergiaActiva = \sum_{n=1}^{n=\alpha} \frac{P_n}{3600}$$

$$EnergiaReactiva = \sum_{n=1}^{n=\alpha} \frac{Q_n}{3600}$$

2.9.- Quality service

2.9.1.- Voltage out of limits

To calculate the variable when the voltage is out of limits, 5 variables must be programmed on the meter: Nominal voltage, Threshold separation, Higher voltage set point, Lower voltage set point, Minimum duration out-voltage.

The following information will be saved for each event: kind of event (Exceed voltage or faulty voltage), start date and hour, end date and hour, with a resolution of a second.

A) *Nominal voltage*

This is the nominal voltage value of the supply (phase-phase voltage). This value will be the one to take to consider is there is an event on the line: if the voltage is out of limit in the upper lever or in the lower level. For CT meters this voltage will be the primary voltage.

B) Threshold separation

Is the limit value in % of the nominal voltage where all the values under this limit will be considered as an interruption. If the value is below the limit, the data will treat as supply interruption (see point 2.9.2).

C) Higher voltage set point

Is the limit value in % of the nominal voltage which is summed to the nominal voltage where all the values above this limit are considered overvoltages. If this value is set to zero, the meter will not register this kind of event.

D) *Lower voltage set point*

Is the limit value in % of the nominal voltage which is rested to the nominal voltage where all the values below this limit are considered interruptions. If this value is set to zero, the meter will not register this kind of event.

E) Minimum duration out-voltage

Is the minimum time where the voltage has to be out of limits (continuously) to create a voltage event. If this value is set to zero, the meter will not register this kind of event.

2.9.2.- Supply interruptions

To calculate the variable when the voltage is out of limits, 3 variables must be programmed on the meter: Nominal voltage, Threshold separation, Minimum duration out-voltage.

The meter will separate the incidences in curse (still actives) from the closed incidences (finished). In each event the following parameters will be saved: affected phase, initial event date and hour and final date and hour. With a resolution of a second.

A) Nominal voltage and Threshold separation

Those parameters are defined on the previous points. The values under this limits will be voltage interruptions.

B) .Minimum duration out-voltage

Is the minimum time where the voltage has to be out of limits (continuously) to create a voltage event (interruption). If this value is set to zero, the meter will not register this kind of event. If this value is set to zero, the meter will not register this kind of event.

3.- METER OPERATION

In this section we describe the behaviour of the equipment from a functional point of view. In other words, we will explain how to manage all of the information that it gives us, as well as how to configure the different functions of the system.

3.1.- Navigation and viewing modes

To navigate through the different information screens, the read button will be used. Movement within the same level will be done using short presses of the button. To access a higher level, a long press will be used. The device will return to stand-by mode 60 seconds after the last press of the button.

3.1.1.- Stand-by mode

The device is in this mode by default until one of the buttons is pressed.

The stand-by screens are designed to present information cyclically, without the need to carry out any action upon the meter. This kind of navigation is exclusive to the stand-by mode.

The scrolling line will alternate the information once every 6 seconds. When the read button is pressed once quickly (short press), the reading from the totalizer being displayed in that moment will be frozen on the screen.

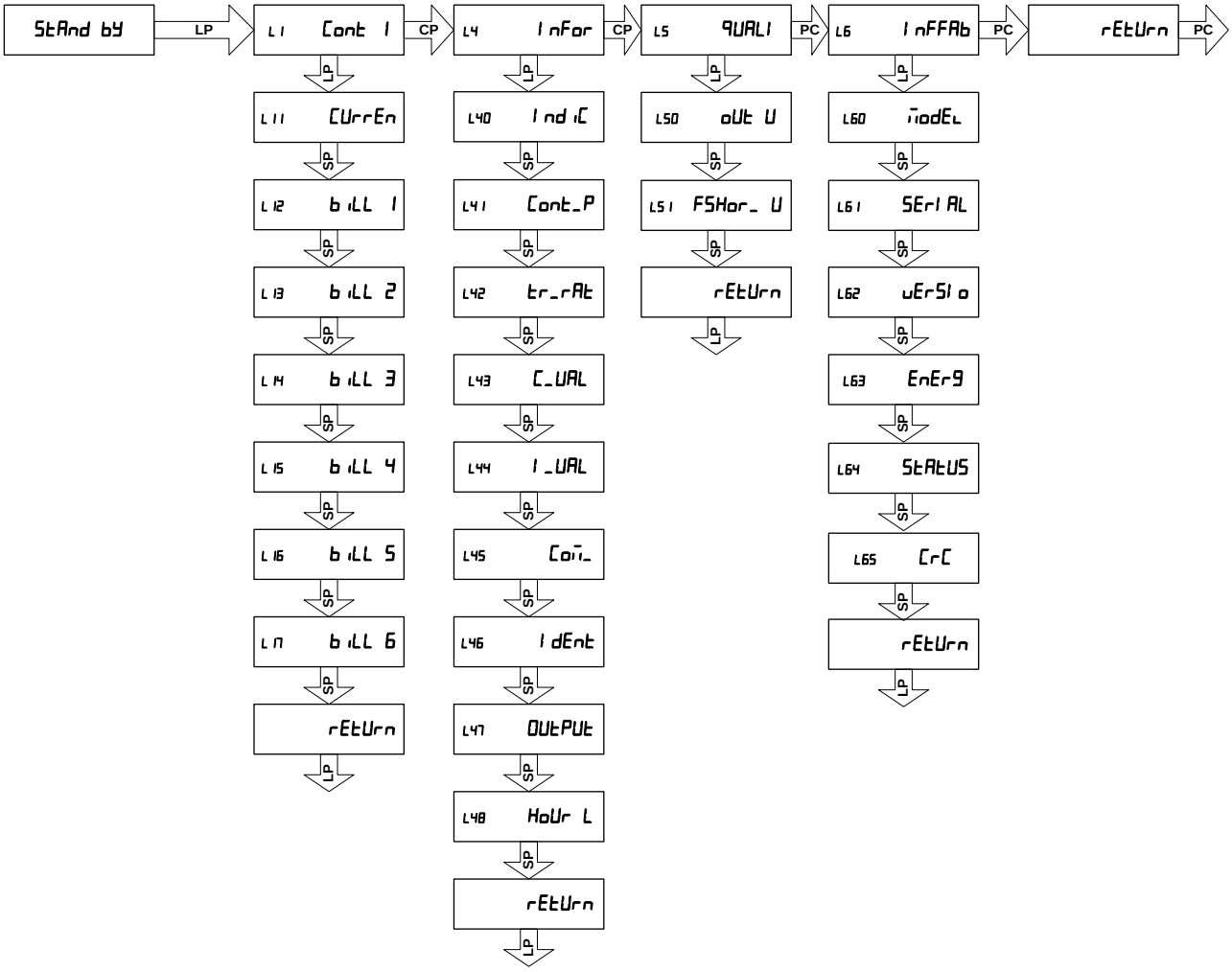
Using short presses, the user can navigate manually through all of the defined totalizers.
On devices configured for a simple active tariff, the stand-by screen will only show a static view of the active totalizer.

3.1.2.- Read mode

This mode is activated by pressing and holding down the read button (long press). Navigation within the same level will be cyclic.

This mode uses a tree structure of screens, organized into three hierarchical levels, through which the information is accessed.

The diverse information that can be displayed in the Read mode will be browsed through using the Read button, and short and/or long presses of this same button.


StAnd bY
LP
L1 Cont 1
CP
L4 InFor
CP
L5 QUALI
PC
L6 InFFAb
PC
rEtUrn
PC
L11 CUrrEn
L12 biLL 1
L13 biLL 2
L14 biLL 3
L15 biLL 4
L16 biLL 5
L17 biLL 6
rEtUrn
L40 IndiC
L41 Cont_P
L42 tr_rAt
L43 C_UAL
L44 I_UAL
L45 Coñ_
L46 IdEnt
L47 OUtPUt
L48 HoUr L
rEtUrn
L50 oUt U
L51 FSHor_ U
rEtUrn
L60 ñodEL
L61 SErIAL
L62 uErSIo
L63 EnEr9
L64 StAtUS
L65 CrC
rEtUrn
LP
SP

3.2.- Screen definition

3.2.1.- Stand by mode screen

Using short presses, the user can navigate manually through all of the defined totalizers.

Link address and measuring point number

Total imported active energy

Total exported active energy

Total reactive energy: quadrant 1

Total reactive energy: quadrant 2

Total reactive energy: quadrant 3

Total reactive energy: quadrant 4

Date and time

3.2.2.- Menu screens

Screen L1 (CONTRACT 1)

This is the screen that gives access to the information about contract 1. It is a MENU screen.

It gives access to other, secondary MENU screens.

Screens	Text	Comments
L1	L11 CUrrEn	Access the current values of contract 1
	L12 bILL 1	Access the values of contract 1 from closure 1 (most recent)
	L13 bILL 2	Access the values of contract 1 from closure 2
	L14 bILL 3	Access the values of contract 1 from closure 3
	L15 bILL 4	Access the values of contract 1 from closure 4
	L16 bILL 5	Access the values of contract 1 from closure 5
	L17 bILL 6	Access the values of contract 1 from closure 6 (oldest)
	rEtUrn	Return to the previous screen

Screen L11 (CONTRACT 1: CURRENT)

This is the screen that shows the information about the current values of contract 1. Upon entering this menu, two data viewing options appear: absolute values and incremental values.

The ABSOLUTE option (Abs) provides us with the absolute active and reactive energy values, as well as the power excesses and maximum demands.

The INCREMENTAL option (Inc) provides us with the incremental active and reactive energy values since the last billing closure, as well as the power excesses and maximum demands. If no option is selected, the Absolute values will be displayed by default following the next press of the button.

On both of the screens, only the active information will be displayed, i.e. if certain tariffs or registers, such as the power excesses or maximum demands, have not been activated, no information regarding them will appear on the screen. Shown below are the codes for the Absolute values:

	Abs Absolute values		
		OBIS	
L11	KWH	1.18.1	Active Energy tariff periods since measuring began (if they are active), including the total (period 0) 1.18.x where x = tariff (period)
	KWH	1.18.2	
	KWH	1.18.3	
	KWH	1.18.4	
	KWH	1.18.0	
	KVARL	1.58.1	Q1 Reactive Energy tariff periods since measuring began (if they are active), including the total (period 0) 1.58.x where x = tariff (period)
	KVARL	1.58.2	
	KVARL	1.58.3	
	KVARL	1.58.4	
	KVARL	1.58.0	
	Power Excesses	1.12.1	Excesses since last billing closure (if they are active) 1.12.x where x = tariff (period)
	Power Excesses	1.12.2	
	Power Excesses	1.12.3	
	Power Excesses	1.12.4	
	MAXIMUMS	1.16.0	Maximums since the billing closure (if they are active), including the total (period 0) 1.16.x where x = tariff (period)
	MAXIMUMS	1.16.1	
	MAXIMUMS	1.16.2	
	MAXIMUMS	1.16.3	
	MAXIMUMS	1.16.4	

Shown below are the codes for the incremental values:

	Inc Incremental values		
		OBIS	
L11	KWH	1.19.1	Consumption by Active Energy tariff periods since measuring began (if they are active), including the total (period 0) 1.19.x where x = tariff (period)
	KWH	1.19.2	
	KWH	1.19.3	
	KWH	1.19.4	
	KWH	1.19.0	
	KVARL	1.59.1	Consumption by Q1 Reactive Energy tariff periods since measuring began (if they are active), including the total (period 0) 1.59.x where x = tariff (period)
	KVARL	1.59.2	
	KVARL	1.59.3	
	KVARL	1.59.4	
	KVARL	1.59.0	
	Power Excesses	1.12.1	Excesses since last billing closure (if they are active) 1.12.x where x = tariff (period)
	Power Excesses	1.12.2	
	Power Excesses	1.12.3	
	Power Excesses	1.12.4	
	MAXIMUMS	1.16.0	Maximums since the billing closure (if they are active), including the total (period 0) 1.16.x where x = tariff (period)
	MAXIMUMS	1.16.1	
	MAXIMUMS	1.16.2	
	MAXIMUMS	1.16.3	
	MAXIMUMS	1.16.4	

Screen L12 (CONTRACT 1: CLOSURE 01)

This shows information about the values of contract 1 from the last closure. The screen behaves in the same way as L11, with the option of Absolute or Incremental values.

	Abs Absolute values		
		OBIS	
L11	KWH	1.18.1.1	Active Energy tariff periods since measuring began until the last closure (if they are active), including the total (period 0) 1.18.x.01 where x = tariff (period)
	KWH	1.18.2.1	
	KWH	1.18.3.1	
	KWH	1.18.4.1	
	KWH	1.18.0.1	
	KVARL	1.58.1.1	Q1 Reactive Energy tariff periods since measuring began until the last closure (if they are active), including the total (period 0) 1.58.x.01 where x = tariff (period)
	KVARL	1.58.2.1	
	KVARL	1.58.3.1	
	KVARL	1.58.4.1	
	KVARL	1.58.0.1	
	Power Excesses	1.12.1.1	Excesses since last billing closure (if they are active) 1.12.x where x = tariff (period)
	Power Excesses	1.12.2.1	
	Power Excesses	1.12.3.1	
	Power Excesses	1.12.4.1	
	MAXIMUMS	1.16.1.0	Maximums since the billing closure (if they are active), including the total (period 0) 1.16.x where x = tariff (period)
	MAXIMUMS	1.16.1.1	
	MAXIMUMS	1.16.2.1	
	MAXIMUMS	1.16.3.1	
	MAXIMUMS	1.16.4.1	

Shown below are the codes for the incremental value variables:

Inc Incremental values		
	OBIS	
KWH	1.19.1.1	Consumption by Active Energy tariff periods from the last billing period (if they are active), including the total (period 0) 1.19.x.01 where x = tariff (period)
KWH	1.19.2.1	
KWH	1.19.3.1	
KWH	1.19.4.1	
KWH	1.19.0.1	
KVARL	1.59.1.1	Consumption by Q1 Reactive Energy tariff periods from the last billing period (if they are active), including the total (period 0) 1.59.x.01 where x = tariff (period)
KVARL	1.59.2.1	
KVARL	1.59.3.1	
KVARL	1.59.4.1	
KVARL	1.59.0.1	
Power Excesses	1.12.1.1	Excesses since last billing closure (if they are active) 1.12.x where x = tariff (period)
Power Excesses	1.12.2.1	
Power Excesses	1.12.3.1	
Power Excesses	1.12.4.1	
MAXIMUMS	1.16.1.0	Maximums since the billing closure (if they are active), including the total (period 0) 1.16.x where x = tariff (period)
MAXIMUMS	1.16.1.1	
MAXIMUMS	1.16.2.1	
MAXIMUMS	1.16.3.1	
MAXIMUMS	1.16.4.1	

Screen L13 (CONTRACT 1: CLOSURE 02)

This shows information about the values of contract 1 from the penultimate closure. The screen behaves in the same way as L12.

The information is displayed in exactly the same way as on screen L12, but field F will take the value 02 instead of 01.

For example: 1.18.1.2 → Absolute active energy consumed, in period 1, from the penultimate billing closure.

Screen L14 (CONTRACT 1: CLOSURE 03)

This shows information about the values of contract 1 from the closure prior to the penultimate one. The screen behaves in the same way as L12.

The information is displayed in exactly the same way as on screen L12, but field F will take the value 03 instead of 01.

For example: 1.18.1.3 → Absolute active energy consumed, in period 1, from billing closure 3.

Screen L15 (CONTRACT 1: CLOSURE 04)

This shows information about the values of contract 1 from closure 04. The screen behaves in the same way as L12.

The information is displayed in exactly the same way as on screen L12, but field F will take the value 04 instead of 01.

For example: 1.18.1.4 → Absolute active energy consumed, in period 1, from billing closure 4.

Screen L16 (CONTRACT 1: CLOSURE 05)

This shows information about the values of contract 1 from closure 05. The screen behaves in the same way as L12.

The information is displayed in exactly the same way as on screen L12, but field F will take the value 05 instead of 01.

For example: 1.18.1.05 → Absolute active energy consumed, in period 1, from billing closure 5.

Screen L17 (CONTRACT 1: CLOSURE 06)

This shows information about the values of contract 1 from closure 06. The screen behaves in the same way as L12.

The information is displayed in exactly the same way as on screen L12, but field F will take the value 06 instead of 01.

For example: 1.18.1.06 → Absolute active energy consumed, in period 1, from billing closure 6.

Screen L4 (INFORMATION)

This is the screen that gives access to the information not related to the billing values of the contracts.

It gives access to the other, dependent MENU screens, shown below:

Screens	Description	Comments
L40 Indic	OPERATING INDICATORS	For checking that all of the fundamental aspects of the equipment are working correctly, during installation or during subsequent in situ checks.
L41 Cont_P	CONTRACTED POWER	Used to indicate the values of the contracted powers. Only applies to power excesses in Contract 1.
L42 tr_rAt	TRANSFORMER RATIOS	Displays information about the transformer ratios.
L43 C_VAL	CURRENT VALUES	Displays information about the current values of power, maximum, totalizers, and the power of the last integration period (15 minutes by default).
L44 I_VAL	INSTANT VALUES	Displays information about the instant values of different electrical factors.
L45 Coñ	COMMUNICATIONS	Displays information about the different communications port parameters.
L46 IdEnt	IDENTIFIERS	Displays information about the different device IDs, including those relating to the IEC870-5-102 protocol.
L47 OUtPUt	OUTPUT CONSTANTS	Displays information about the output impulse values.
L48 HoUr L	CLOCK CHANGES	Displays information about daylight saving clock change dates.
rEtUrn	BACK	Returns to the previous screen.

Screen L40 (INFORMATION: INDICATORS)

This is the screen that shows the information about the operating indicators. It is used to check that all of the fundamental aspects of the equipment are working correctly, during installation or during subsequent in situ checks.

Display	OBIS	Description
L40 Indic	0.13.38 e.g. 1	**ACTIVE QUADRANT**: Indicates the direction of the active and reactive energy or quadrant (1, 2, 3 or 4).
	0.12.38 e.g. 123	**VOLTAGE PRESENCE**: Indicates the presence of voltage in each phase (123 if all have voltage, blank if there is no voltage present)
	0.11.38 e.g. 120	**CURRENT DIRECTION**: Indicates the input (+) or output (-) direction in each phase (111 if they are inputs, 222 if they are outputs, 000 if they do not exist).
	0.18.12 e.g. 633	**ACTIVE TARIFF OF EACH CONTRACT**: Indicates the active tariff, at the moment of reading, of each contract (contract 1, contract 2, contract 3) (values ranging from 1 to 6 for each contract).
	0.96.2.4 e.g. 0	**PARAMETERISATION MODE**: Indicates whether or not the parameterisation mode is enabled (0 disabled, 1 enabled).
	0.96.5.0 e.g. C	**ALARMS**: Indicates the alarms defined in section 1.7. The data field will display the letters **Cnb**, which will appear depending on the nature of the alarm.

Screen L41 (INFORMATION: CONTRACT PARAMETERS)

This is the screen that shows the information about the contracted power of contract 1. Only applies to power excesses in Contract 1. It is a DATA screen.

Display	OBIS	Description
L41 Cont_P	1.135.1	**CONTRACTED POWER**: Indicates the values, in kW to 2 decimal places, of the contracted powers that will be used for calculating the excesses. 1.135.x where x = tariff (period)
	1.135.2	
	1.135.3	
	1.135.4	

Screen L42 (INFORMATION: TRANSFORMER RATIOS)

This is the screen that shows the information about the transformer ratios. It is a DATA screen.

Display	OBIS	Description
L42 tr_rAt	0.04.2	**CURRENT RATIO PRIMARY**: Displays the value of the primary of the current ratio, to 1 decimal place.
	0.04.5	**CURRENT RATIO SECONDARY**: Displays the value of the secondary of the current ratio, to 1 decimal place.
	0.04.3	**VOLTAGE RATIO PRIMARY**: Displays the value of the primary of the voltage ratio, to 1 decimal place (compound voltage).
	0.04.6	**VOLTAGE RATIO SECONDARY**: Displays the value of the secondary of the voltage ratio, to 1 decimal place (compound voltage).

Screen L43 (INFORMATION: CURRENT VALUES)

This is the screen that shows information about the current values of power, maximum, totalizers, and the power of the last integration period (15 minutes by default). It is a DATA screen.

Display	OBIS	Description
L43 C_VAL	0.18.0	**TOTALIZER A+:** Displays the value of the current totalizer of Active Energy taken from the network.
	0.28.0	**TOTALIZER A-**: Displays the value of the current totalizer of Active Energy injected to the network.
	0.58.0	**TOTALIZER R1**: Displays the value of the current totalizer of Reactive Energy from quadrant 1.
	0.68.0	**TOTALIZER R2**: Displays the value of the current totalizer of Reactive Energy from quadrant 2.
	0.78.0	**TOTALIZER R3**: Displays the value of the current totalizer of Reactive Energy from quadrant 3.
	0.88.0	**TOTALIZER R4**: Displays the value of the current totalizer of Reactive Energy from quadrant 4.
	0.14.0	**CURRENT POWER INPUT**: Displays the value of the average input power being integrated during the current integration period.
	0.24.0	**CURRENT POWER OUTPUT**: Displays the value of the average output power being integrated during the current integration period.
	0.15.0	**LAST PERIOD POWER INPUT**: Displays the value of the average input power that has been integrated during the last integration period.
	0.25.0	**LAST PERIOD POWER OUTPUT**: Displays the value of the average output power that has been integrated during the last integration period.

Screen L44 (INFORMATION: INSTANT VALUES)

This screen displays information about the instant values of different electrical factors. Since said data does not correspond to any specific contract, but is instead data which is relevant to all of them, field B takes the value 0.

Display	OBIS	Description
L44 I_UAL	0.32 7.0	**VOLTAGE PER PHASE**: These display the instant voltage values for each phase.
	0.52 7.0	
	0.72 7.0	
	0.3 1 7.0	**CURRENT PER PHASE**: These display the instant current values for each phase.
	0.5 1 7.0	
	0.7 1 7.0	
	0.33 7.0	**COS Φ PER PHASE**: These display the instant cos Φ values for each phase.
	0.53 7.0	
	0.73 7.0	
	0. 17.0	**INSTANT ACTIVE POWER**: Displays the total instant Active Power value for the three phases with their symbol.
	0.37.0	**INSTANT REACTIVE POWER:** Displays the total instant Reactive Power value for the three phases with their symbol.
	0. 137.0	**AVERAGE POWER FACTOR**: Displays the average instant Power Factor value for all the phases.

Screen L45 (INFORMATION: COMMUNICATIONS)

This screen displays information about the different communications port parameters. Since said data does not correspond to any specific contract, but is instead data which is relevant to all of them, field B takes the value 0.

Display	OBIS	Description
L45 Con	0.00.0	**OPTICAL SERIAL PORT CONFIGURATION**: 000000n (009600 speed, n parity).
	0.00. 1	**ELECTRICAL SERIAL PORT 1 CONFIGURATION**: 000000n (009600 speed, n parity).
	0.00.2	**ELECTRICAL SERIAL PORT 2 CONFIGURATION**: 000000n (009600 speed, n parity).
	0.00.3	**ELECTRICAL SERIAL PORT 1 MODEM STARTUP MODE**: The data corresponding to the protocol's ASDU 142 will be displayed.

Screen L46 (INFORMATION: IDENTIFIERS)

This screen displays information about the different device IDs, including those relating to the IEC-870-5-102protocol. Since said data does not correspond to any specific contract, but is instead data which is relevant to all of them, field B takes the value 0.

Display	OBIS	Description
L46 IdEnt	0.00.5	**LINK ADDRESS**
	0.00.6	**MEASURING POINT ADDRESS**
	0.00.7	**DATA OF THE COMMUNICATIONS PROTOCOL VERSION: (DD-MM-YY)**, showing the data corresponding to the protocol's ASDU 142.
	0.02.0	**DEVICE FIRMWARE VERSION**: showing the data corresponding to the protocol's ASDU 142.
	0.08.4	**INTEGRATION PERIOD OF THE FIRST LOAD CURVE**: indicates the integration period, in minutes; 60 minutes by default.
	0.08.5	**INTEGRATION PERIOD OF THE SECOND LOAD CURVE**: indicates the integration period of the second load curve, in minutes; 15 minutes by default.

Screen L47 (INFORMATION: OUTPUT CONSTANTS)

This screen displays information about the output impulse values. Since said data does not correspond to any specific contract, but is instead data which is relevant to all of them, field B takes the value 0.

Display	OBIS	Description
L47 OUtPUt	0.03.3	OUTPUT 1
	0.03.4	OUTPUT 2
	0.03.5	OUTPUT 3
	0.03.6	OUTPUT 4

The options for each output type are:

Ax Y :	x = 1:active imported / x = 2 : active exported / Y = impulse weight
Rx Y :	x = quadrant no. (reactive quadrant x) / Y = impulse weight
Vh Y :	Impulse output Vh (average of 3 phases) / Y = impulse weight
Pot :	Maximeter
C x P y :	x = contract no. / y = tariff period no. (the output indicates the tariff)

Screen L48 (INFORMATION: CLOCK CHANGES)

This screen displays information about daylight saving clock change dates. Since said data does not correspond to any specific contract, but is instead data which is relevant to all of them, field B takes the value 0.

Display	OBIS	Description
L48 HoUr L	0.00.8	**WINTER-SUMMER CLOCK CHANGES**: Indicates the date and time of the winter to summer daylight saving clock change.
	0.00.9	**SUMMER-WINTER CLOCK CHANGES**: Indicates the date and time of the summer to winter daylight saving clock change.

Screen L5 (QUALITY)

This is the screen that gives access to the information related to quality aspects of the supply voltage. It is a MENU screen.

It gives access to the other, dependent MENU screens, shown below:

Screens	Description	Comments
L50 oUt U	Time outside limits	Time outside limits
L51 FSHor_ U	Voltage ausence	Voltage ausence

Screen L50 (QUALITY: VOLTAGE OUTSIDE LIMITS)

This screen displays the times during which the voltages have been outside of their limits.

Display	OBIS	Description
L50 oUt U	1231.0	**VOLTAGE MEASUREMENT BETWEEN PHASES WITHIN LIMITS:** Total time, in minutes, during the last 30 days.
	3231.0	**PHASE 1 VOLTAGE WITHIN LIMITS:** Total time, in minutes, during the last 30 days.
	5231.0	**PHASE 2 VOLTAGE WITHIN LIMITS:** Total time, in minutes, during the last 30 days.
	7231.0	**PHASE 3 VOLTAGE WITHIN LIMITS:** Total time, in minutes, during the last 30 days.
	1235.0	**VOLTAGE MEASUREMENT BETWEEN PHASES OUTSIDE LIMITS:** Total time, in minutes, during the last 30 days.
	3235.0	**PHASE 1 VOLTAGE OUTSIDE LIMITS:** Total time, in minutes, during the last 30 days.
	5235.0	**PHASE 2 VOLTAGE OUTSIDE LIMITS:** Total time, in minutes, during the last 30 days.
	7235.0	**PHASE 3 VOLTAGE OUTSIDE LIMITS:** Total time, in minutes, during the last 30 days.

Screen L51 (QUALITY: VOLTAGE LOSS)

This screen displays the times during which voltages have been lost.

Display	OBIS	Description
L51 FSHor_ U	1242.0	**ALL VOLTAGES LOST**: Total time, in minutes, during current year.
	3242.0	**VOLTAGE 1 LOST**: Total time, in minutes, during current year.
	5242.0	**VOLTAGE 2 LOST**: Total time, in minutes, during current year.
	7242.0	**VOLTAGE 3 LOST**: Total time, in minutes, during current year.
	1242.1	**ALL VOLTAGES LOST**: Number of occurrences in current year.
	3242.1	**VOLTAGE 1 LOST**: Number of occurrences in current year.
	5242.1	**VOLTAGE 2 LOST**: Number of occurrences in current year.
	7242.1	**VOLTAGE 3 LOST**: Number of occurrences in current year.

Screen L6 (MANUFACTURER INFORMATION)

This is the screen that gives access to the information related to quality aspects of the supply voltage. It is a MENU screen.

It gives access to the other, dependent MENU screens, shown below:

Screens	Description	Comments
L60 ModEL	Counter model	Counter model
L61 SErIAL	Serial number	Serial number
L62 uErSIo	Meter version	Meter version
L63 EnEr9	Energy, in Wh	Displays the active energy imported
L64 StAtUS	Shows the meter alarmas	Most important alarms
L65 CrC	CRC code	CRC code

Screen L60 (MANUFACTURER INFO: MODEL)
This screen displays the meter model.

Screen L61 (MANUFACTURER INFO: SERIAL)
This screen displays the serial number.

Screen L62 (MANUFACTURER INFO: VERSION)
This screen displays the meter version.

Screen L63 (MANUFACTURER INFO: ENERGY)
This screen displays the active energy imported, expressed in kWh to 3 decimal places. This screen is very useful for accuracy tests.

Screen L64 (MANUFACTURER INFO: STATUS)
This screen displays the most important meter alarms.

Screen L65 (MANUFACTURER INFO: CRC)
This screen displays the CRC code.

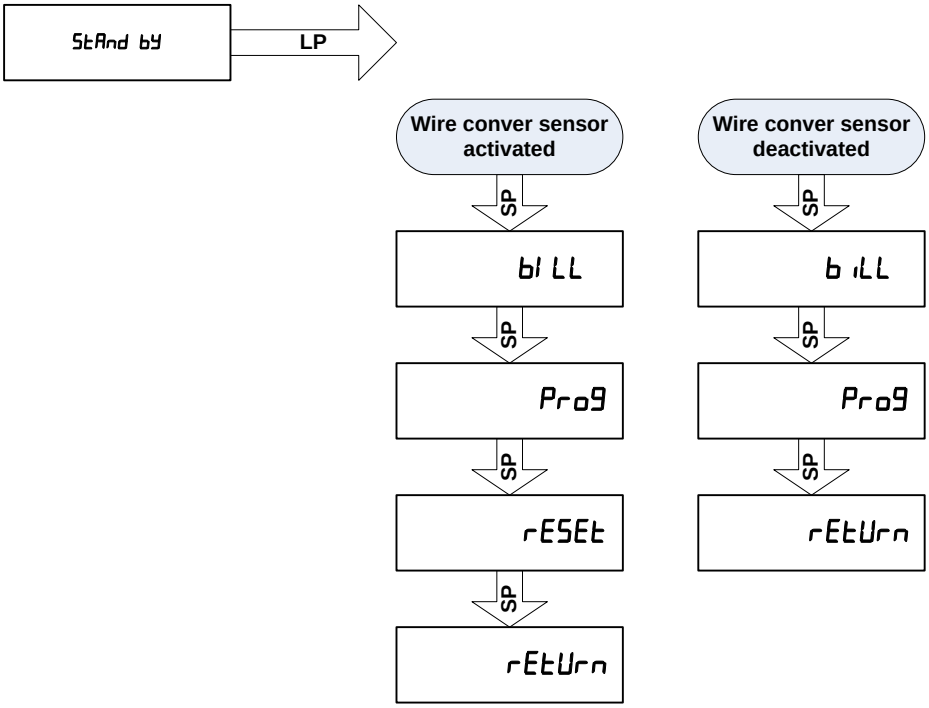
3.2.3.- Special functions

The sealable button and/or the wire cover sensor will be used to access the Special Functions. To navigate through the different information screens, the **sealable button** will be used, with movement within the same level being controlled by short button presses (SP). To access a higher level, a long button press will be used (LP).

The **BACK** option at the end of the two menus will allow the user to go back to the stand-by screen following a long press of the sealable button.

Validation will always be via a long press of the sealable button.

The device will return to Stand-by mode 60 seconds after the last press of the button.



Closure menu

After carrying out a contract closure (C1, C2 or C3), the following screen will be displayed, remaining on screen for 3 seconds:

If the manual closure feature is inactive on the device due to communications, the following message will be displayed on screen for 3 seconds:

Special programming menu

This enables the modification of those parameters that require the seal of the sealable button to be broken. Such is the case of the transformer ratios and the integration period of the load curves.

Reset menu

This feature deletes any programmed parameters and all the stored data. The totalizers are reset to zero. The date and time are kept, along with the battery status and the parameters set by the manufacturer.

The default parameters are used, which are as follows:

Link address	1
Measuring point address	1
Keys	1
Speed in all ports	9600 baud
Configuration of all ports	8N1
Seasonal changes	Automatic

This function will always be carried out locally and is protected by the seals on the wire cover and the button. A zero reset event will be generated in each case.

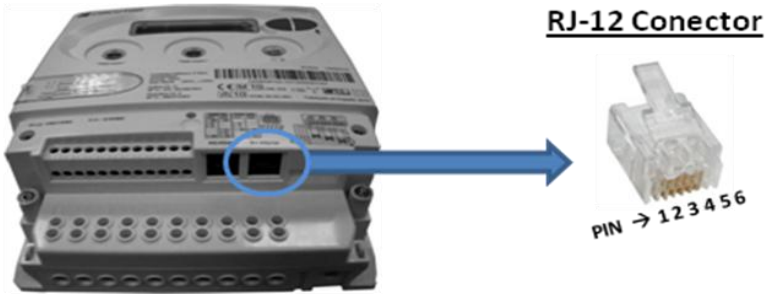
The screen will display the following message:

4.- COMMUNICATIONS

Cirwatt B could have different communication modules. It description is:

4.1.- RS-232 Communication

This is a point-point communication, it means that the meter is connected directly to the device used for configuration and programming.



RS-232	
CIRWATT RJ-12	PC DB -9
1- GND	5- GND
2- RX	3- TX
3- TX	2- RX
6 - GND	5 - GND

RS-232	
CIRWATT DB-9	PC DB -9
2- RX	3- TX
3- TX	2- RX
5- GND	5- GND

4.2.- RS-485 Communication

This kind of communication allows creating a communication bus up to 32 devices, it maximum distance can be 1200 meters.

RS-485
CIRWATT RJ-12
1 - GND
4 - A (+)
5 - B (-)
6 - GND

DB-9 Conector

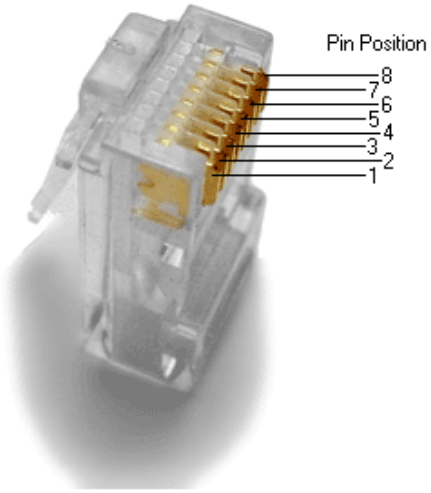
RS-485
CIRWATT DB-9
5 - GND
6 - B (-)
7 - A (+)

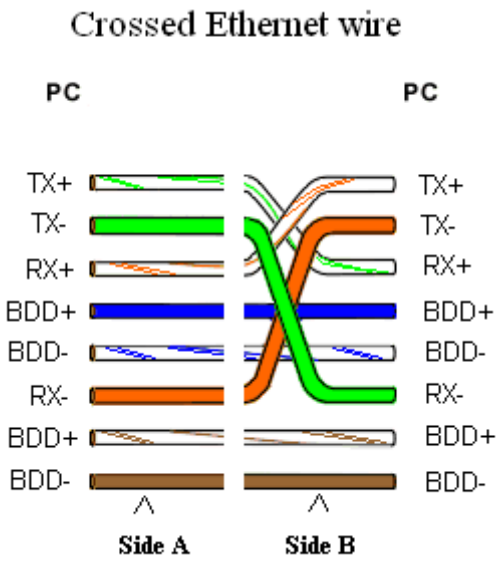
4.3.- Ethernet communication

With this kind of communication an internal IP network can be created. There is no limitation on the number of devices to be installed.

To configure the meter it must be directly connected to one computer using a crossed Ethernet wire by connecting this into the RJ-45 meter connector situated under meter the wire cover, as shown into the following drawings:

RJ-45 Connector



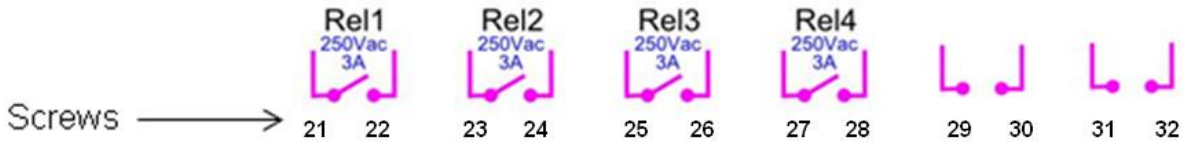


5.- EXPANSION MODULES

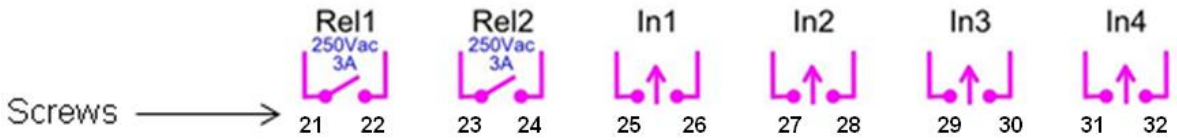
Different communication modules can be optionally implemented. It description is:

		Expansion modules				
		4 relay outputs (tariff indicator)	**2 relay outputs / 4 pulse inputs**	**4 pulse inputs**	**Earth leakage measurement**	**2 relay outputs/ 2 pulse outputs/ 2 pulse inputs**
SCREWS	**21**	Relay output 1	Relay output 1	---	Input 1S1	Relay output 1
	22	Relay output 1	Relay output 1	---	Input 1S2	Relay output 1
	23	Relay output 2	Relay output 2	---	---	Relay output 2
	24	Relay output 2	Relay output 2	---	---	Relay output 2
	25	Relay output 3	Contact input 1	Contact input 1	---	Optocoupler output 1 -
	26	Relay output 3	Contact input 1	Contact input 1	---	Optocoupler output 1 +
	27	Relay output 4	Contact input 2	Contact input 2	---	Optocoupler output 2 -
	28	Relay output 4	Contact input 2	Contact input 2	---	Optocoupler output 2 +
	29	---	Contact input 3	Contact input 3	---	Contact input1
	30	---	Contact input 3	Contact input 3	---	Contact input1
	31	---	Contact input 4	Contact input 4	---	Contact input2
	32	---	Contact input 4	Contact input 4	---	Contact input2

5.1.- 4 relay outputs (tariff indicator)

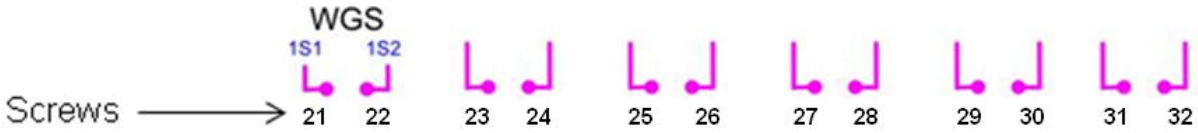


5.2.- 2 relay outputs / 4 pulse inputs

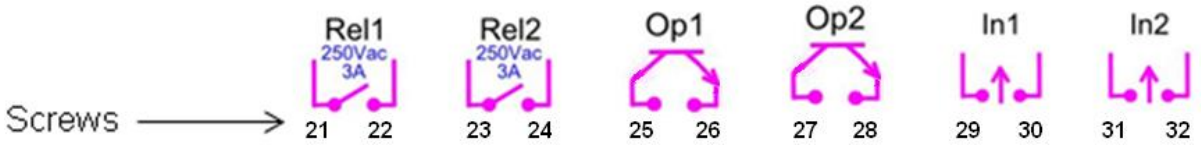


5.3.- 4 pulse inputs

5.4.- Earth leakage measurement



5.5.- 2 relay outputs/ 2 pulse outputs/ 2 pulse inputs



6.- READING AND PARAMETRIZATION SOFTWARE

All of the meters are fitted with an optical communications channel. Communication via PLC by means of a modem driver or concentrator, via electric port, or via IP access is also possible.

The optical interface complies with the electrical and mechanical specifications of the IEC62056-21 standard. The direction of the analyzer and the correct password are needed in order to communicate with it.

With this software, all the options available on the meter can be configured and all the information that it contains can be downloaded.

7.- INSTALLATION AND START-UP

7.1.- Installation

The meter has been designed in accordance with the DIN 43857 standard defining the sizes and the mounting points.

It must be remembered that once the equipment is connected, the terminal may be dangerous when touched and opening the covers or removing pieces may access parts that are dangerous when touched. The equipment must not be used until it is fully installed.
To connect the meter always starts with the neutral connection and then the rest of the phases. To disconnect proceed in the opposite way, first the phases and then neutral wire. Otherwise the meter can be damage if there is voltage on the screws during the process.

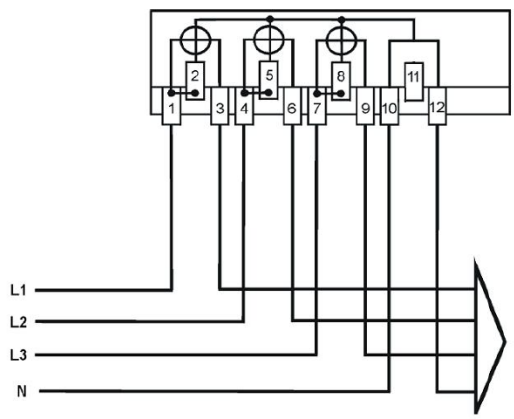
.

Warning : All connections must be inside the terminal cover.

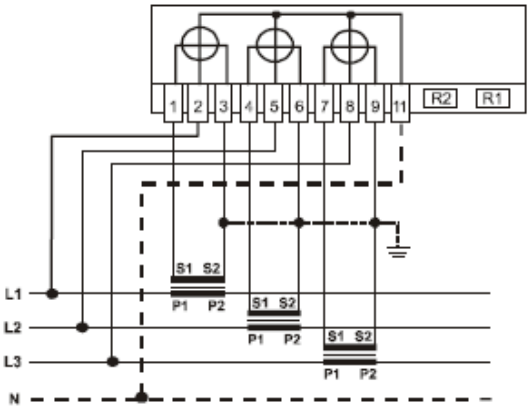
7.2.- Meter connection diagrams

Each CIRWATT model is especially designed for a different type of three phase system, therefore the connection diagram will vary.

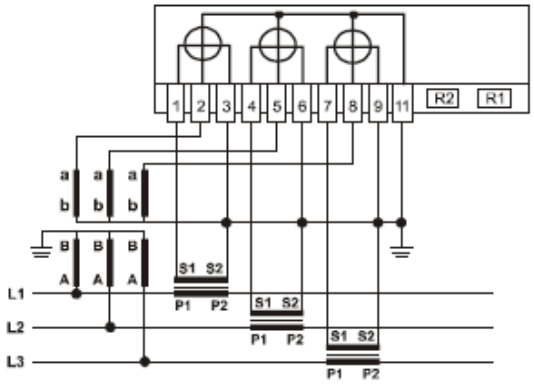
Direct connection



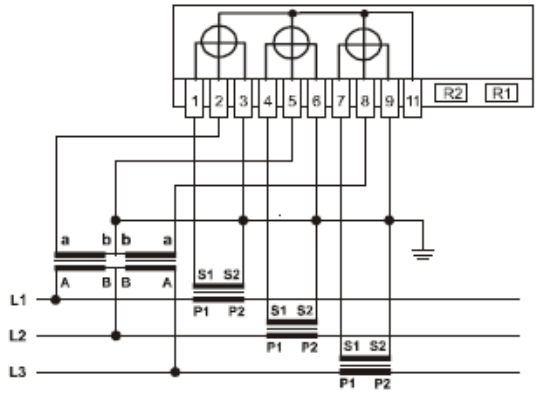
CT connection



3 / 4 wire connection (Low Voltage)



4 wire connection
3 voltage transformers and 3 current transformers



3 wire connection
2 voltage transformers and 3 current transformers

The required connection diagram is located marked by laser on the frontal cover

8.- MAINTENANCE

Cirwatt TB does not need any special maintenance actions.

9.- LIABILITY LIMITATIONS

CIRCUTOR, SA reserves the right to make changes, without previous notice.

The term of the CIRCUTOR guarantee is two years from the date of purchase and is limited to refund of the purchase price, repair free of charge, or replacement of defective equipment that is returned to CIRCUTOR post-sales service within the term of the guarantee.

CIRCUTOR, SA makes the latest versions of its device specifications and the most up to date manuals available to its clients on its web site www.circutor.es and www.circutor.com.

10.- TECHNICAL ASSISTANCE SERVICE

In case of any equipment failure or any operational queries please contact the technical service of CIRCUTOR S.A.

In case of any equipment failure or any operational queries please contact the **technical assistance service** of CIRCUTOR S.A. INTERNACIONAL: **(+34) 93 745 29 00**	**CIRCUTOR, SA** Vial Sant Jordi, s/n – 08232 – Viladecavalls (Barcelona) Tel. +34 93 745 29 00 – Fax: +34 93 745 29 14 Web:www.circutor.com email: sat@circutor.es